UNIVERSITY OF PRETORIA

Department of Civil Engineering

# INTRODUCTION TO THE MASTER'S AND DOCTORAL PROGRAMS IN THE DEPARTMENT OF CIVIL ENGINEERING

January 2012

**INTRODUCTION TO THE**
**DOCTORAL PROGRAMS OF THE**
**DEPARTMENT OF CIVIL ENGINEERING**

## 1. INTRODUCTION

Regulations governing postgraduate study in the Department of Civil Engineering at the University of Pretoria are contained in various documents, such as the Postgraduate Brochure and the Annual Calendars. Some of the processes which have to be followed are not documented and are invariably transmitted orally. This state of affairs could lead to confusion of prospective candidates, or newly enrolled graduate students. The aim of this brochure is to draw attention with regards to the different administrative stages that have to be fulfilled in the doctoral programs. This objective will also ensure that the recommended procedures are followed in all the disciplines in the Department.

Postgraduate education is provided in the following disciplines :

- Geotechnical engineering
- Structural engineering
- Transportation engineering
- Water resources engineering

Initially this brochure gives an overview of the format of reports which are required. Thereafter the admission requirements, course requirements, development of reports and the method of their evaluation for the respective programs is presented.

## 2. FORMAT OF REPORTS

A report in partial fulfilment of the academic requirements is required for the doctoral programs. The only difference between the programs is the extent and scope of the report. For the master's degree either a project report or a dissertation must be prepared, depending on the required number of credits. For a doctorate a thesis is required. The main distinction between a doctoral thesis and a master's dissertation is that the former makes an original scientific contribution whereas the latter does not necessarily make such an original contribution. The master's reports need to demonstrate that the candidate has successfully mastered the art of scientific research. The project report is of limited scope and extent when compared to the dissertation. The former should take about a quarter the time of the latter.

Guidelines for the preparation of these documents are contained in "Guidelines for project reports, dissertations and theses" which is available from the department.

Apart from the completion of the relevant report, the University also expects that at least one paper on the topic of the research be published in a recognised journal with the Supervisor as co-author. Generally in the case of doctoral studies more than one paper is published.

## 3. DOCTORAL THESIS

### 3.1 Admission requirements

All candidates have to apply for admission to the Doctoral program. A student admitted to the PhD program will normally hold a master's degree from a recognised institution, and will be a mature professional, preferably with professional registration in the case of an engineer or technologist.

The first step in the application process is for the Head of the Department to approve in principle the candidature and appoint a potential Supervisor to assist with the preparation of the application. The candidate then has to prepare a project proposal in conjunction with the Supervisor. Such a planning report will contain the following elements :

Proposed title of the thesis

Introduction and background to the study
Problem statement
Objectives of the study
Scope and extent of the study
Statement about the contribution to the state of knowledge
Provisional format of the report in the form of an index
Detailed work program, including a bar chart.

A three-page CV of the student, including a list of previous publications and engineering experience.

An example of a planning report is given in Appendix A. Note that the style could vary.

A copy of the candidate's master's dissertation/project report must also be submitted.

On completion of the proposal the candidate will be interviewed by a Departmental Admissions Committee, who would make recommendations for final decision by the Departmental Management Committee. Once the candidate is accepted by the Department the normal University application form is completed.

Only after all the formalities have been completed can the candidate formally commence with the research. When the research work is well in progress, the research title is registered with the Faculty administrative office by the Supervisor, who also recommends external examiners. The external examiners are often internationally recognised specialists resident overseas.

### 3.2 Course work

Depending on the academic history of the candidate and the intended course of research, the Departmental Management Committee can recommend that he/she take designated courses.

### 3.3 Evaluation

After completion of the literature review, the clear definition of the research objectives and some progress, a public presentation is held where the research proposal and progress is presented to practitioners.

On completion of the thesis the candidate must with approval of the Supervisor, submit three ring-bound copies to the Faculty office for examination. The examination is arranged by the Faculty administrative office. It is Faculty policy that external examiners remain anonymous until after the examination. An oral examination forms part of the examination process.

One bound and one unbound final copy of the thesis, incorporating recommended improvements following the examination, must be deposited with the Faculty administrative office for use in the library. Bound copies are also required for the Supervisor and external examiners. Note the colour of the cover for each discipline as given in Table 1. In addition, a 300 word loose leaf abstract and an abbreviated CV for use at the graduation ceremony must be submitted to the Faculty administrative office.

The University of Pretoria Annual Calendars should be consulted for final submission dates for the graduation ceremonies which are held during the year.

## **APPENDIX A**

Planning report for project reports, dissertations and theses

# THE COMPACTABILITY OF G1 CRUSHED STONE MATERIALS

AN OTHER

Planning report for study towards the degree of ..... at the University of Pretoria

Date: .....

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## 1. INTRODUCTION AND BACKGROUND

In South Africa the G1 crushed stone is used to produce quality stone upper pavement layers which can be used for most heavily trafficked roads. The current catalogue of design most widely used in South Africa, TRH4, uses the G1 crushed stone in pavements designed to carry up to 50 million standard axles.

The G1 graded crushed stone material is generally derived from the crushing or solid unweathered quarried rock, clean rock from mine dumps or clean rock boulders, as specified in TRH14. It meets certain specified quality and grading requirements, and faulty gradings may only be adjusted by the addition of fractions obtained from the crushing of the parent rock. It is placed at near saturation moisture content and the field density is specified as a percentage of the apparent density of all-in material and expressed as relative compaction. Relative compaction requirements range from 86 to 88 percent.

In some cases material which complies with there requirements has been difficult to compact, and contractors have been unable to achieve the specified density. Since it was unclear why the problems arose, research were done to investigate the material properties that affect the compactability.

Although properties were discovered which influence the compactability it is uncertain whether the present compaction methods reflect the true compaction process. The need now exists to simulate the true compacting process due to traffic action and to determine the properties of traffic consolidated G1 materials.

## 2. PROBLEM DEFINITION

Previous research investigated the influence of different properties on the compactability of G1 crushed stone, since it was unclear why problems arose. The porosity of the coarse aggregate, was for example found to be one contributing factor. The previous research used vibratory and impact compaction techniques. These methods do not necessarily reflect the compaction actions during construction and under traffic conditions.

The needs exists to investigate the influence of traffic on the consolidation of the crushed stone materials and to determine if the specified compaction is initially needed. To simulate traffic movement the Gyratory Testing Machine provides a moulding compaction process, which is to be explored.

This is however a sophisticated machine, which has never been implemented on South African G1 crushed stone. Testing the G1 crushed stone in this manner will therefore provide a new prospective on the behaviour of this material. The reliability of this testing machine under these new conditions will also have to be determined.

## 3. OBJECTIVES

The objective of the study is to investigate the influence of traffic on the consolidation of crushed stone materials and to determine certain properties of G1 materials under traffic simulated conditions.

The following will be investigated:

- consolidation properties;
- the compaction regime;
- the stability index and
- the gyratory shear modulus.

## 4. RESEARCH PROGRAM

### 4.1 Activities

A1 **Literature review** - (2 weeks)
Further investigation into the properties and existing testing method will be acquired. The precise procedure how to operate the machine must be studied to ensure the highest degree of precision and reproducibility.

A2 **Calibration of the Gyratory Testing Machine** - (2 weeks)
Since the machine is old and has not been used regularly it has to be calibrated to make sure that the results given are accurate.

A3 **Simulation of a E-80 wheel load on the Gyrator Testing Machine** - (1 week)
To simulate traffic one needs to determine the angle of the gyratory action and the correct combination and magnitude of loads to be representative of the forces experienced in the pavement.

A4 **Effects of traffic on shear, settlement and consolidation properties of G1 materials** - (2 weeks)
Existing equations will be used to determine above mentioned properties . These results will then be compared to values from existing tests, for example the resilient modulus.

A5 **Effects of traffic simulation on compactability of different materials** - (2 weeks)
The Fuller and Gap gradings of the following materials will be tested:

i. Eikenhof,
ii. Jukskei,
iii. River gravel,
iv. Scoops and
v. mixtures of Eikenhof and River gravel.

A6 **Relationship between under-compaction and eventual compaction due to traffic loadings** - (2 weeks)
The effects of under compaction will be compared to the eventual compaction due to consolidation.

A7 **Editing of the final report** - (2 weeks)
The finalising of all conclusions will be made and documented.

### 4.2 Time Management Chart

## 5. PROPOSED STRUCTURE OF REPORT

| | |
|---|---|
| Chapter 1 | Introduction and Problem definition |
| Chapter 2 | Literature review |
| Chapter 3 | Calibration of Gyratory Testing Machine |
| Chapter 4 | Simulation of a E-80 wheel load on the Gyratory Testing Machine |
| Chapter 5 | Effects of traffic on shear, settlement and consolidation properties of G1 materials |
| Chapter 6 | Effects of traffic simulation on compactability of different materials |
| Chapter 7 | Relationship between under-compaction and eventual compaction due to traffic loadings |
| Appendices | Appendices will be added to support the report as needed. |

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